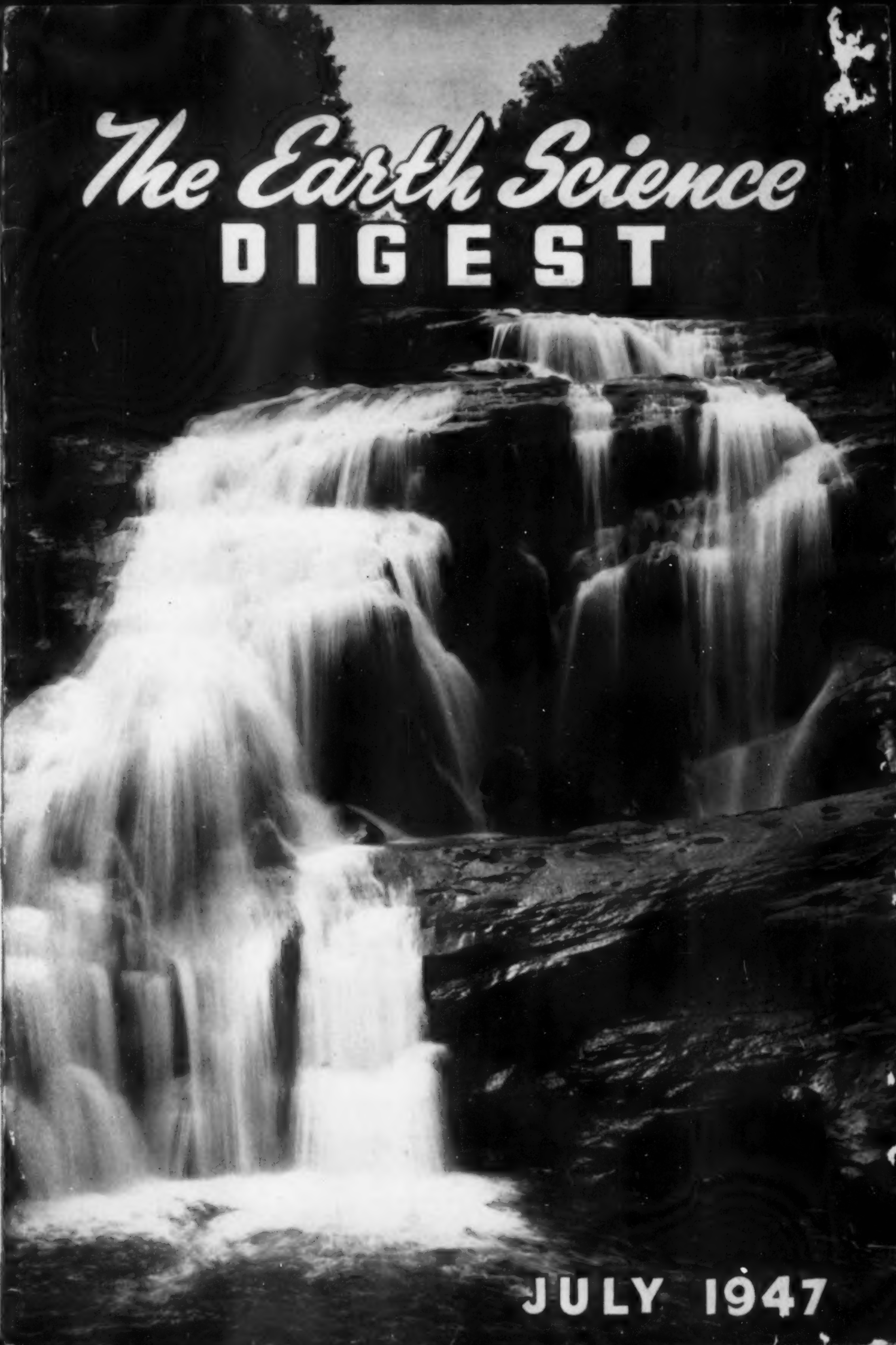
The Earth Science DIGEST



JULY 1947

The Earth Science Digest

Box 57 Omaha 3, Nebraska

Published monthly by
The Earth Science Publishing Co.

R. B. Berry .... **Editor**
M. R. Humphrey .... **Associate Editor**
Jerome Eisenberg .... **Feature Editor**
Alice L. Hart .... **Circulation and Business Manager**

SUBSCRIPTIONS

Per copy	**$ .25**
1 year	**2.00**
2 years	**3.75**
3 years	**5.00**

Advertising rate card will be sent upon request.

Vol. I July - 1947 No. 12

Contents

EDITORIAL

Many of our readers have written asking why the Digest is so late each month. There is a very good explanation for this and we feel that our subscribers are entitled to the whole story.

The paper shortage now is even more critical than it was during the war. Our deliveries on paper are 30 days late, hence the magazine is about 40 days late. We entertained hopes that by August we could get back on schedule, but the paper situation has gone from bad to worse. Our paper for the April issue failed to arrive so we had to use what is known as an "off-set" paper. This detracted from the quality of the magazine and ruined the quality of photo reproduction so we had to discontinue use of this type of stock.

There is some hope that we can have an ample supply of paper on hand by the last part of September. As soon as we procure a sufficient supply the magazine will be mailed on our usual publication date of the tenth of the month of the date of issue. We hope subscribers and advertisers will bear with us during the shortage, for as soon as ample paper is available, the magazine will not only be published on time, but the number of pages will be increased considerably.

NORTHWEST FEDERATION

The Northwest Federation of Mineral Societies will assemble at the Civic Auditorium in Seattle on August 30th. The two day meeting will feature the largest display of minerals and lapidary equipment ever set-up on the Pacific Coast.

Associated societies working with their hosts, the Gem Collector's Club of Seattle, have reserved many cases for their show specimens. These together with the many excellent displays of dealers who will be represented, indicate a strong feeling that this is one event no rockhound will miss, no matter what the obstacles may be.

The convention will open at nine o'clock on the morning of August 30 and will close at five o'clock in the afternoon of Sunday, August 31st. Featured among the events on the two day program will be the raffling of a large diamond saw and a complete polishing unit donated by a western lapidary company.

Together with the great variety of specimens arranged for at the Civic Auditorium, visitors are urged not to overlook the jade collections at the Art Museum in Volunteer Park. This material represents one of the most complete collections in this country.

The Gem Collector's Club, hosts to the Northwest Federation, look forward to greeting many visitors, and send a welcome to all to come to Seattle for this meeting and for a pleasant time.

COVER PHOTO

This month's cover photo is of a waterfall in the Smoky Mountains National Forest in East Tennessee. $5.00 first prize in the July cover photo contest goes to Monkmeyer Press Photo Service of 225 Fifth Ave., New York, N. Y. We remind readers that all entries in the September contest must be in our office not later than August 25th. If photos arrive too late for the September contest they will be entered in the October contest. All entries should be on 6 x 9 high gloss paper and should be accompanied by return postage.

How To Prospect For Radioactive Minerals With a Geiger Counter

By John W. Petersen

All atomic minerals possess a property known as radioactivity. By radioactivity we mean they emit invisible high speed rays, many of which are called gamma rays. The Geiger Counter is an instrument capable of detecting these gamma rays, and if used properly will determine their approximate concentration. For prospecting purposes several light weight, compact, counters are available that are an invaluable aid to the rare earth seeker. Equipped with carrying straps and designed for field use, the counter is indispensable for locating rare earth deposits.

Most field sets come equipped with a set of earphones. Locating radioactive mineral deposits is done by merely listening for clicks while moving about in a promising area. As the counter approaches a radioactive substance the clicks increase in number and withdrawal will result in a proportional decrease. Most field units are operated very simply. There are no confusing dials or gadgets to adjust before the set will function properly. All that confronts the operator is a small lightweight box with an off-on switch, a pair of earphones, and the testing probe.

Turning the switch to the "on" position should produce clicks in the earphones. This is an indication that the set is functioning properly. If there are no radioactive substances in the vicinity the clicks heard will be caused by cosmic rays striking the probe from the outer atmosphere. In prospecting it should always be remembered that there will always be a few clicks caused by these cosmic rays. For most prospecting purposes the cosmic clicks may be disregarded except as an indication that the counter is operating properly. The "background" will be decreased considerably when the tube is operated inside buildings, near cliffs, underground, etc.

We had some of these considerations in mind as we began investigation of some deposits in northwestern Colorado. On this trip we had with us a model TX-5 Geiger counter manufactured by Omaha Scientific Supply Co., of Omaha, Nebraska. Our base camp was located west of Craig, Colorado. We were looking specifically for carnotite. The carnotite in this region appears in the form of a yellow amorphous powder often disseminated in coal. It can be very easily mistaken for sulphur. There were a number of abandoned mines in this vicinity and we gave each a close examination. By exploring the mine dumps with the counter probe we could usually determine whether or not there were radioactives in the mine. This saved us considerable time that would have otherwise been spent inside the mine. Specimens we found on several dumps were found to be highly radioactive. In a few hours we picked up ten pounds of high grade carnotite from one dump. An abandoned coal mine yielded excellent specimens of carnotite in coal. Carnotite in coal is sometimes impossible to locate by sight and without the helpful counter our specimen bags would probably have been filled with low grade material. Some of the specimens we found appeared to be replacements after petrified wood.

Trouble was encountered keeping the counter and our clothing free from radioactive dust. It was found necessary to leave the full specimen bags in our car because if carried with us they would throw off our readings. After digging in the deposits for several hours we noted that our shoes and other articles of clothing had become slightly radioactive. Even dust which lodged under our fingernails after digging out specimens would register on the counter. We soon found that to remain free from contamination in this area was no easy task.

This is not the case when prospecting in igneous zones for minerals like pitchblende or other radioactives that occur in crystalline or botroydial state. Greatest care should be taken prospecting for *earthy* radioactives. After a few hours of operating the TX-5 we became highly proficient in locating subsurface deposits by merely inspecting the surface outcrops. Enthusiasm was at a high peak and it wasn't long before we were flipping coins to see who would use the counter and who would have to do the digging.

We can safely say that without the Geiger counter it would have been virtually impossible to locate any of the pockets which were covered by overburden. This is because the counter will record radiations from the subsurface as easily as it will detect surface specimens. We obtained indications at distances up to thirty feet. When the counter is brought within thirty feet of any radioactive deposit of any extent it required very little effort to find the exact position of the deposit. All that is necessary to determine the location of the ore is for the operator of the counter to walk back and forth across the area where the increased count is noted. In almost every instance a point will be noticed where the clicks are more frequent than at any other point. Removal of the overburden at this point usually will uncover a seam or cavity of ore. Samples of the ore may be spot checked to give an approximate evaluation. We have always found it advisable before leaving for the field to purchase a standard sample of known concentration to use for comparison purposes. To check an unknown sample, trim to the approximate size of the purchased standard. Hold the standard sample at a given distance from the counter probe and note the number of clicks. Then take the unknown sample and, holding at the same distance, record the number of clicks. between the standard and unknown will give the approximate concentration of the ore.

Uranium has been found in many places in the United States. Listed below are the known states in which uranium minerals occur. Many other localities have uranium deposits that haven't been found, due to the lack of sufficient exploration.

Colorado	California
Maine	Idaho
Massachusetts	Utah
Connecticut	New Hampshire
New York	North Carolina
Arkansas	Virginia
Georgia	Pennsylvania
Oregon	New Mexico
Arizona	Wyoming
South Dakota	Minnesota

For a detailed list of the localities in each of the aforementioned states which have uranium minerals, consult *Handbook of Uranium Minerals* by H. C. Dake and Jack DeMent.

Uranium is also found in Canada. The most famous locality in Canada is the Great Bear Lake deposit. Uranium has been found in numerous other places in Canada and it would seem that there is a good chance for discovery of new deposits. Much of Canada has never been geologically surveyed and these regions present a challenge to the enterprising prospector.

While most Geiger counters are built and designed to withstand rigorous field use, nevertheless, they must be treated with a reasonable amount of care. The units are constructed much like a radio and, not unlike radios, they will not stand such rough treatment as dropping, immersion in water, or subjection to extreme heat. The counter should not be used during thunder storms or other electrical disturbances. Each counter has certain definite characteristics peculiar only to itself. In order that the operator may become proficient he should familiarize himself with one instrument. If the counter should ever cease to function for any reason the operator should not attempt to repair it. Tampering with the instrument could very easily make repairing costly and difficult. Manufacturers of this type of equipment usually have repair departments with experienced electronic personnel. For a nominal service charge any unit can be put in good order.

It is necessary that the counter unit be kept dry at all times in order to avoid shorts in the high voltage circuit that might result in severe damage to the unit. Batteries are provided with the unit that give long service if it is properly used. Do not leave the counter on when not in use. If this precaution is observed the set should give many hours of satisfactory service.

Many different substances are radioactive, among them being rock, dust, and water. It is very easy for the operator to unconsciously accumulate in his clothing and equipment these substances in large enough quantities to seriously impair the operation of the unit. Clothing, shoes, and sample bags, may all be tested for contamination with the Geiger counter by separating suspected articles and inspecting each individually. To remove radioactive substances from specimen bags or other contaminated articles, wash thoroughly in a strong solution of Calgon. Wash repeatedly until all traces of radioactivity are removed. Test with counter tube if necessary.

The prospector's model should never be operated in places where carnotite, pitchblende or other radioactive minerals are being mined. Excessive radiation may cause the counter tube to become paralyzed.

If the operator of the counter adheres to the above recommendations regarding use of the instrument he can enjoy many trouble free hours of service.

The Geiger counter is indeed a most versatile instrument. Counters have been manufactured that can be lowered into diamond drill holes for deep subsurface inspection. Pitchblende deposits in pegmatite dikes have been traced in this manner at the famous Great Bear Lake locale in Canada. Counters have been used for grading and sorting ores at several mines in the Colorado River Basin. Perhaps the most important application of Geiger counters that is now being developed is based on the fact that radioactives are frequently associated with heavy minerals. Hence it may be possible to detect deposits of heavy minerals by checking for radioactivity. Gold, silver, zinc, and lead ores are in many cases slightly radioactive. By carefully checking mineralized areas for radioactivity it will be possible to lo-

(To Page 31)

BIRTHSTONE FACTS AND LEGENDS

By Miss Jewell Casey

Few people know that birthstones owe their origin to the Bible, instead of superstitious legends. Of the various lists, due to different reasons in various countries, all birthstones are based on one or the other of two groups of gems mentioned in the Bible.

The first precious stones mentioned were the 12 stones in Priest Aaron's breastplate as described in Exodus 39: 10-13; namely: Sardius, topaz, carbuncle, emerald, sapphire, diamond, ligure, agate, amethyst, beryl, onyx, and jasper.

The next mentioned were the "Foundation Stones" of the New Jerusalem, as set forth in Revelations 21: 19-20, and were: Jasper, sapphire, chalcedony, emerald, sardonyx, sardius, chrysolyte, beryl, topaz, chrysoprasus, jacinth, amethyst, beryl, onyx, and jasper.

It was during the First Century that Josephus associated the stones of the breastplate with the months of the year. Then in the Fifth Century, St. Jerome associated one particular gem to each of the signs of the Zodiac.

At one time it was customary to wear all 12 precious stones in a single ornament, so sincere was the belief in the virtures of the Biblical jewels. One famous woman wore a girdle composed of the 12, each stone engraved with the different signs of the Zodiac.

It was from the ancient Polish belief that each month had a certain precious stone associated with it that originated birthstone superstitions. With few substitutions of modern names for ancient Biblical ones, the traditional list of America follows the gems of the breastplate.

Gem For July

TURQUOISE, the gem stone designated for July, is another of the birthstones which is not mentioned in the Bible. The name of the stone is from French word denoting the gem was imported from Turkey.

The turquoise is a delicate blue or bluish green shade and the finest of these stones comes from Persia, however, very pretty specimens are found in limited areas of New Mexico, Colorado, Arizona, Nevada, and California.

The turquoise is the national gem of the Persians, where the stone is used for ornamenting swords and charms and girdles, as well as other decorative purposes. The finest specimens of turquoise are supposed to belong to the shah of Persia.

The Persians, in order to avoid evil and to achieve good luck, are careful to see the new moon for the first time only by its reflection from the face of a friend, from a copy of the Koran, or from a turquoise.

Perhaps the turquoise is accredited with the strongest magic of any stone—it is supposed to be able to heal the difference between man and wife! In addition to that strong magic, it will keep men from straying from the straight and narrow path.

The heav'n blue turquoise should adorn
All those who in July are born;
For those they'll be exempt and free
From love's doubts and anxiety.

(Author Unknown)

The RUBY, in some lists, is birthstone for July, which has power, according to legend, to correct evil resulting from mistaken friendship, discovers poison, and frees one from unhappy thoughts.

VERSATILE OOZE

By Eugene W. Nelson

Some 20,000 years ago when our earth was much younger than it is now, an elephant-like creature which scientists today call a mastodon, lumbered too close to the edge of what seemed to be an innocent pond of black, stagnant water. Only it wasn't water. It was a thick, black, sticky mass that oozed and bubbled forth continuously from the earth's interior. The ooze caught and held and slowly covered up the mastodon despite his titanic efforts to free himself — and today you can see the bones of that identical beast on exhibition at the Museum of Natural History in Los Angeles. Those bones defied the universal law of decay because the black ooze that held them fast was the best preservative nature has ever produced — asphalt.

Asphalt is a mineral substance composed of the two elements, hydrogen and carbon. Its origin goes back to the very dawn of creation when ocean was well nigh universal and the first faint stirring of organic life was in seaweed and in the one-celled diatom. The unending cycle of life and death and life built up a deep sedimentary bed through the accumulation of organic remains on the ocean floor. Then came stupendous upliftings and a shuffling of ocean beds and whole continents, accompanied by incredible heat and pressures. As a result of this heating and squeezing, the sediment was partly changed into petroleum. Held in solution in the petroleum was the non-volatile "hydrocarbon" compound which we know as "asphalt".

When petroleum emerged from the sea, some of it came out into the sunlight although most of it was trapped and held underground. Since most of the petroleum products — such as kerosene and gasoline — are volatile, these constituents evaporated in the sunshine and air. The residue — a sort of dried-out petroleum seemingly immune to change and decay — remained in place. This immunity to change and decay was the quality which preserved the bones of the mastodon and marked asphalt as the greatest preservative ever compounded in Nature's workshop.

There are many deposits of natural asphalt — as this material is called when it is found in "free" deposits — scattered throughout the world. The most famous one today is the vast asphalt lake on the West Indian Island of Trinidad. This lake covers an area of more than 100 acres. Drillings made for more than 175 feet straight down through the asphalt have failed to touch the bottom of the deposit. The remarkable thing about this Trinidad Lake is that — although literally tons of the black ooze have been removed during the past century — nowhere on the lake's surface is there a hole or a depression of any sort. When a shipment of asphalt is dug up and carted away, the excavation is completely filled up again during the next few days by some mysterious and seemingly inexhaustible supply far down beneath the earth's crust.

Another famous source of supply of asphalt in the olden days was the accumulation of this sticky mineral substance on the shores of the Dead Sea in Palestine. There were many other places where asphalt could be mined, however, by the men who lived many centuries ago. In fact, this adhesive material was one of the very first of nature's treasures to be used by man.

In the fertile river valleys where the olden civilizations flourished, vast systems of irrigation ditches and dams had to be built to conserve the water and so insure a plentiful supply of the precious liquid over a period of an entire year. Both the irrigation ditches and the dams were lined with asphalt to keep the life-giving water from soaking away into the thirsty sand long before it reached the crops in the fields.

Returning for a moment to the astounding preservative properties of asphalt, it is interesting to note that the Arabic word for "asphalt" is "mumija". Since the Egyptians preserved the bodies of their dead by embalming them in asphalt-bearing liquid and then wrapping them in asphalt-soaked cloths, the buried bodies came in time to be called "mummies". The Egyptians believe that a dead person would need all the things in his after-life that he needed in this world. So the relatives of a dead person would soak his wooden furniture and his cotton garments in asphalt and bury them in the tomb beside the mummy. It is to this practice that the world today owes its complete knowledge of the life and customs of the ancient Egyptians.

One by one the great civilizations of the ancient East crashed down in ruins. Rome, as great a nation of builders as ever existed, used an enormous amount of asphalt. But when Rome eventually joined the other civilizations in decay, the Dark Ages settled down all over Europe and England. Among the many arts and crafts which men forgot during that terrible time was the use of asphalt to preserve things from rot, and to make walls and roads strong and enduring.

In fact, it was not until well along in the Eighteenth Century that men again began to locate asphalt deposits and to experiment with this mineral. Even though Sir Walter Raleigh actually discovered the great asphalt lake on Trinidad and used a little of the material to calk up the spreading seams of his ship, nothing more was done with this tremendous source of natural riches until well along in the 1800's. If Sir Walter could only have developed his find, he would have made a lot more money than he ever did by searching for El Dorado!

It was in the 1800's that the uses of asphalt began to grow and multiply so rapidly that today it is known as one of nature's most versatile products. Due to the magic of modern industrial chemistry, however, we no longer have to depend upon the natural asphalt which must be dug up laboriously and then transported for thousands of miles in carts, ships, and trains.

Today, the petroleum industry furnishes the manufacturers with all the asphalt they can use — and here in the United States alone that amounts to between four and five billion tons of the black ooze every year, an amount valued at between forty and fifty million dollars! The oil refinery duplicates in a short time what it took nature many, many centuries to accomplish — that is, the evaporation of the easily volatilized portions of the petroleum, leaving behind the pure asphalt.

The uses to which this black, clutching mineral are being put are practically unlimited. Hundreds of thousands of miles of paved roads in this country are constructed out of asphalt compounded with crushed rock and other materials. In fact, it is claimed that four-fifths of all city streets and nearly half of all the state highways are made in this fashion.

One-fourth of all the asphalt used

(To Page 26)

** Photo at left.

A modern asphalt plant.

Courtesy of The Asphalt Institute of New York City.

The Polished Rocks of Cornudas Mountain New Mexico

Reprinted from "Science"

Walter B. Lang
U. S. Geological Survey
Washington, D. C.

In 1941 (1) I presented my recollections and inferences concerning certain polished surfaces I had noticed on the porphyritic rocks of the Hueco and Cornudas Mountains in Texas and New Mexico. Lately I had opportunity to give more than casual attention to the appearance and relation of the polished surfaces to the rocks on which they are found about Cornudas Mountain.

Both Cornudas Mountain and the Hueco Tanks, which lie along the western Texas and New Mexico boundary and are about 35 miles apart, are plugs or laccolithic intrusions injected in Permian strata from the same igneous magma. The rock is a porphyritic syenite composed of potash feldspar with a small amount of plagioclase, and hornblende, amphibole, biotite, and magnetite. Fresh specimens of the rock range in color from faint pink to a pale gray, depending on the inherent color of the feldspar. Weathering of the rock frees iron from the ferromagnesian minerals, and a coating of hydrous iron is formed over the weathered surface of the rock which imparts to it a dark reddish-brown color and causes the mountain to glisten in the sun like copper-bronze.

The natural rupture of the rock, either by fracture or spalling, produces a roughened, hackly surface. The fracture tends to pass around rather than through the phenocrysts of feldspar. Thus, the feldspars commonly stand out as much as an eighth of an inch or more above the general level of rock surface. Spotted over this natural roughened surface of the rock are occasionally to be found highly polished areas. These polished surfaces were seen only on the southeast side of Cornudas Mountain and only within a relatively narrow zone where the coarse rock talus at the base of the cliffs meets the detrital apron. Some enormous blocks of rock have fallen from the cliffs and tumbled out to isolated positions on this surrounding and flat-lying detrital apron. Most of these show some evidence of polish.

Often within the center of a polished area covering 5 to 25 square feet of rock there are no irregularities—only a smooth glassy surface. This highly polished surface grades outward into a normal rough rock surface through a marginal zone wherein the phenocrysts stand out like rounded and polished cameo buttons in a rough, granular, intaglio background. Thus, a gradation in the state of perfection of the polish is displayed. In the marginal zone the projections of the phencrysts are progressively less rounded off outward, and the depressions have received no polish where the higher protrusions are not well worn down. It is evident that the polish is due to lapping by a flexible medium which was capable of following to some degree the irregularities of the original surface and thus extending the buffing process somewhat into the recessed part of the surface. Only one agency is likely to have produced such an effect upon these rocks: It is a common habit for grazing animals to choose certain places to scratch their hides. The hides of animals contain oily matter, and this, when combined with the fine dust which animals habitually toss upon themselves, forms an effective abrasive capable of wearing away rock and producing a high polish.

An examination in section of the polished surface shows a thin discoloration band, extending an average of 1/50 inch in depth, which is apparently due to absorption of animal fat. It is different in appearance from that due to the staining by hydrates of iron. To determine the presence of oil or fat, a piece of the rock having 4 square inches of polished surface was submitted to W. W. Brannock, of the Chemical Laboratory, Geological Survey, for test. The material was treated with carbon bisulfide after being broken into coarse fragments, and the solvent was evaporated in a porcelain dish. For even so small an area of polished surface as that borne by this piece of rock a very sizeable spot of honey-yellow oily matter remained on the porcelain dish. A blank test of the carbon bisulfide proved that oily matter had been extracted from the rock. The associated brown stain was also chemically proved to be an iron compound.

Under low-power magnification a shriveled coating of an amber-colored substance was repeatedly observed on the surface of the highly polished feldspar phenocrysts. This material had the appearance of a dried-out oil film, but both flame and heat tests failed to show any expected results. The material proved refractory. Microscopic examination disclosed that it is isotropic and is silica in the form of opal. From these facts it is deduced that the fine silica dust mixed with oily fats was rubbed on the surface of the rocks by animals, and that in the decades, if not centuries, of exposure to the elements since the last animal used the rock for a rubbing post, the silica weathered to opal, and the oil gradually vanished from the surface film. As the oil distilled away in the heat of the sun, the film shrank, and the residuum of opal formed a shriveled and mummified skin on the face of the feldspar phenocrysts.

These few facts seem convincing evidence that the polished surfaces of rock about Cornudas Mountain are of animal origin.

References v. *Lang, W. B. Science*, 1941, 94, 390.

Obsidian Cores from Honduras.—Courtesy Middle Research Institute.

Physical Properties and the Lapidary

By Richard M. Pearl
Colorado College, Colorado Springs

The photograph which accompanies this article illustrates the importance to the lapidary of an understanding of the physical properties of gems. These obsidian "cores" are a product of the lapidary art just as surely as carved ornaments or faceted gems, even though by themselves they are now merely the unused centers or cores from which arrow points had been flaked centuries ago by the natives of Honduras, using implements of bone or other material.

These particular cores vary in length from 3.9 to 5.3 centimeters (1½ to 2 inches), and are in the collection of the Middle American Research Institute of Tulane University in Louisiana.

All gem material, whether mineral or not, that is fashioned by hand, as the obsidian arrowheads were, may be regarded as coming within the province of the lapidary, even though it actually may not be used for ornaments or personal adornment. The workers in stone who produced these cores utilized the physical properties of obsidian to obtain the things that they wanted and needed. At the same time they were limited in the scope of their work by other physical properties of the obsidian.

A study of these properties leads into the field of earth science, broader than gemology or mineralogy alone.

First of all, obsidian is natural glass, which rose from the depths of the earth and either solidified in fissures relatively close to the surface or flowed out upon the ground. Although the original molten material may have had a chemical composition very similar to that of ordinary granite, the latter rock cooled at a considerable depth under a cover of the older rocks into which it had made its way. The granite was therefore insulated and had plenty of time to cool. During this time crystals could grow to visible size, producing the familiar aggregate of common minerals, such as quartz, feldspar, and mica. The same molten material, however, when suddenly exposed to atmospheric temperatures or fairly close to them, would be obliged to cool and solidify rapidly, too quickly to allow for the formation of crystals. The resulting glass, called obsidian, is amorphous; that is, it has no crystalline nature except a microscopic distribution of embryonic crystals, known as microlites and crystallites, in the earliest stages of crystal growth.

The fundamental distinction between glass, such as obsidian, and a crystalline substance, such as any of the minerals that make up granite, lies in the internal structure. Quartz, feldspar, mica, and most other minerals possess a regular internal pattern of atoms which extend in a continuous arrangement in three dimensions throughout the substance. Glass, being noncrystalline, has no such systematic structure, and there is only a haphazard grouping of atoms. The contrast is about like that between a parade of soldiers and a crowd of spectators at a fire.

The significance of this difference in structure is apparent when we realize that the internal make-up of a substance is directly reflected in its outward form and its properties, both optical and physical. When the cohesive forces which hold the atoms together are exceeded by disruptive forces, breakage of course occurs. A crystalline mineral may, under favorable conditions, separate in certain definite directions, exposing flat surfaces. This property is known as cleavage and is entirely dependent upon a systematic internal structure having a weaker attraction in some directions than in others. A noncrystalline gem, like obsidian, can have no such directional separation and must break irregularly, producing a fracture instead of a cleavage.

When the inhabitants of the American continent, like other races elsewhere, used obsidian for their arrowheads and spear points, they made use of this absence of cleavage, developing a remarkable skill in flaking off fragments of the shape they desired by the proper application of pressure and percussion. A cleavable substance could not yield in this fashion, but instead would give flat faces.

Cleavage, however, presents opportunities as well as obstacles to the gem cutter. It is frequently taken advantage of to facilitate splitting gems, thus having the time necessary to saw a stone in order to remove flawed or otherwise undesirable parts or to obtain a more workable shape. This operation is particularly useful in diamond cutting.

Too sensitive a cleavage may, of course, render a gem very fragile. Unusual skill and good luck are required to complete a faceted kunzite

(To Page 32)

Notes on Crinoid Research—Amateur and Professional

By Harrell L. Strimple

The science of Invertebrate Paleontology (fossil animals with no backbone), is a tremendous and fascinating study of life as it existed before the advent of man, a story of great oceans, full of teaming life, covering great portions of the earth which are today dry land, and also a story of simple life struggling to exist under various conditions and striving toward more ideal structure. Some forms have more appeal to certain students than other forms, thus we find one inquisitive mind working with gastropods (snails), another with pelecypods (clams), yet another with trilobites (the great extinct group distantly related to the horseshoe crab). Even in the beginning studies of this science, (which is new when compared to such sciences as astronomy), when almost all fossils were undescribed things, we find the Phyllum (major subdivision of the animal kingdom) Echinodermata (Cystoids, Blastoids, Crinoids, Starfish, etc.), captured the imagination and held the interest of these pioneer scientists. Great volumes have been devoted to the Class - Crinoidea (stone-lily) and even a cursory examination discloses their fascination.

The most prized book in my library is "A Natural History of the Crinoidea or Lily-shaped Animals," J. S. Miller, 1821, illustrated with fifty colored plates. This was given to me by my friend James Wright, the emminent Scottish scientist. I believe it is the first monograph ever published on these beasts. It is said that $100,000 was spent by Frank Springer on "Crinoidea Camerata" and "Crinoidea Flexibilia," Wachsmuth and Springer. The books were never placed on public sale but were reserved for libraries, universities, museums and advanced students. It is certain that Springer spent a fortune on the studies made by Wachsmuth and Springer. James Hall, as State Geologist of New York, contributed many monographs through various state geological reports. F. A. Bather, as curator of geology of the British Museum (Natural History), devoted much of his efforts to the Echinodermata. H. Trautschold, Otto Jaekel, Miller and Gurley, Meek and Worthen, de Koninck, Austin and Austin and a host of others have written extensively on the subject, which brings us to the living authorities.

Dr. R. S. Bassler, and Margaret W. Moody of the U. S. National Museum brought the bibliographic records of the Springer collection up to date and presented in 1943 the highly important "Bibliographic and Faunal Index of Paleozoic Pelmatozoan Echinoderms." Dr. R. C. Moore and Dr. Lowell Laudon, University of Kansas, prepared the crinoid section of the new "North American Index Fossils" along with many other important contributions. Dr. John Wanner, University of Bonn (now retired) has worked up the highly peculiar and controversial forms from the Permian of Timor (Dutch East Indies). Dr. Winifred Goldring has written extensively on Devonian crinoids. Dr. Edwin Kirk, U. S. Geol. Survey, is presenting a constant series on the Mississippian (Lower Carboniferous) crinoids. James Wright has given innumerable papers on the Lower Carboniferous of Scotland and England, and is at present preparing a monograph on the British Crinoidea. Several crinoid studies have appeared under

(To Page 23)

When answering advertisements-- please mention The Earth Science Digest.

FAMOUS LOST MINES

— A Series —

Victor Shaw

(4)

THE LOST DUTCH OVEN MINE

FOR MORE than half a century the story of this lost mine has been legendary. Also, unlike most of the others in our series, the discoverer is still living; or he was when this writer met and talked with him, in the fall of 1941. He is Thomas Schofield and originally was from Los Angeles, California; a prospector and miner of much experience in the desert areas of the Southwest, who found and sold many valuable mines in his long career. When he made this discovery of the "dutch oven mine", Tom was forty-two or forty-three years old, which made him over ninety when we met him; a tall lanky old fellow with snowy hair and rheumy pale blue eyes, with a habit now of gazing dreamily back over his eventful years.

Old Tom says he found this very rich gold mine in the Clipper Mountains, in the late spring of 1894; these hills being situated four or five miles northwest of Danby, which is a tiny station on the Santa Fe R. R. and U.S. 66, some fifty miles west of the town of Needles, in east-central San Bernardino County, California.

When the news of his find broke it created much excitement, and since after leaving the mine Schofield failed utterly to find it again, thousands have since searched the Clippers for it — but in vain. At that time Schofield talked freely giving clear and precise directions and landmarks by which to locate it. Having these directions we had decided to give the Clippers the once-over, that fall of 1941. We knew that old Tom lived at Chambless, a settlement twelve miles west of Danby, but we found him at Danby in the Nielson store, filling station and auto camp. But, we got nothing of any value from the old fellow, he was too vague or perhaps reticent; so we drove to the southern base of the Clippers, over a poor dirt roadway and finally shoved our car as far as possible up the bed of the last dry arroyo and camped.

During the next few days we carefully combed the whole range, but found absolutely none of the landmarks cited in the Schofield directions. In fact, the rock formations there are not at all favorable for deposites of any commercial ores, so far as we could determine. The only "black rocks" we saw, which are a vital point in these directions, was a small area of obsidian on the summit of a northerly spur. There was no "spring" in any canyon, nor willows marking a water course.

This was puzzling, for from the start the Schofield directions were perfectly clear in every detail. And, as it may interest readers of Earth Science Digest, we here give Schofield's story of his "find".

BACK IN 1894, the Santa Fe Railroad needed a water tank in the Danby area, for its heavy freight haul up the grade west from the Colorado River; so Tom Schofield, for his mining experience, was given the contract to drive a tunnel into the south end of Clipper Range, in search of underground water, which when found would be piped to Danby over the favorable down-grade. With his tunnel well started and in charge of his competent shift boss, Tom had much spare time and spent it in customary manner at prospecting the hills for gold veins.

One morning he hiked into a gulch he had never explored and chanced upon a dim old trail, that looked like a game trail. Anyway, he followed it to a water pool that seeped from a cliff base, the pool was clear and cold, with green grass and willow and alder brush and he filled his canteen; but as this proved to be a short box canyon, he back-tracked to where he saw the old trail zig-zagged up the main hill slope. Following this, he tramped over three low hills and the ridges of two hogbacks into another canyon.

Here the old trail seemed well defined, and led him up to a narrow cleft in the cliffs hardly wide enough to let a loaded burro pass between the walls; which seemed to him, he later said "like the twin stone towers of an old English castle". Just beyond this gateway the trail led toward a huge isolated rock on the hillside, and on the other side of this enormous black rock he found the remains of what had been a campsite, evidently abandoned for many years.

The dried old tent flapping in the mountain wind. There was a sagging bunk filled with dead brush and covered by a torn and ragged old blanket. Mining and camp tools badly rusted lay scattered around, an ax, miner's hammers, drills, and iron wedges; the latter evidently used to split up the railroad ties, that formed a large pile nearby. Also there was a fireplace for cooking formed of sootblackened stones, upon which stood one of the largest dutch ovens he'd ever seen, its rusty cover in place.

It was surprising, for nobody in Danby had mentioned prospectors having been here, nor any mining activity, such as the tools indicated. However, the trail led up the hillside and their mine must be above, and as he climbed he soon saw a mine dump where he found a shaft, with its windlass, rope, and ore bucket rusty and weathered but still serviceable. The shaft was built of split rail ties, and nearby cribbed securely with boulders was a large pile of ore.

This ore was of fine blue quartz and every chunk he picked up was liberally flecked and streaked with shining yellow gold. It was the richest ore he'd ever found — a real bonanza; a n d deserted so long, with no assessment work done, it was open for staking. It was *his* now! For a long while he pawed over the ore pile and broke chunks to expose the inside fresh fractures, all showing the same rich gold, until the daylight failed and he realized he'd have to spend the night there.

But, not to sleep. He couldn't even doze beside the fire he made from the old railroad ties, for dreams and plans kept him awake under the stars and time raced as he figured what he'd do with his wealth. And all the while he kept wondering who these men were, and what happened to cause them to so abandon a mine as rich as this. It was incredible.

As soon as day broke next morning, Schofield continued his examination of the mine. He found that the shaft had been sunk upon a long series of parallel veins of varying widths, each vein of the blue quartz being several feet apart, over a dozen veins in all which likely was what geologists call a "sheer zone". In some of the veins the gold formed sizeable solid chunks, but all were equally rich; and he traced the mineralized zone for the length of several full mining claims on both sides of the shaft. A big mine, beyond all doubt.

Back at the shaft, he found the timbering extended to the bottom, and measuring with the frayed rope found its depth was more than sixty feet. But, he dared not trust the rope to examine the ore below. However, by sizing up the amount of ore in the pile he concluded that little if any ore from the shaft had been shipped out. Something must have happened to make them leave, before packing ore out to ship.

By this time he realized that he was hungry and thirsty, so gathering all the ore he could carry he went down to the old campsite. There he hunted all over for a can of something edible, finally lifting off the heavy iron cover of the dutch oven and stood staring dumfounded at its contents. It was filled with gold — almost pure metal obtained, in the usual crude prospector's way, by roasting finely crushed ore down to a rich concentrate. There were several thousand dollars worth in that big dutch oven, almost in saleable form. It was so heavy that he could barely lift it. He needed a burro to pack it away.

By this time Schofield realized that he was ravenously hungry, and his growing thirst brought a mental picture of the pool of water back along the trail. So, saving a few samples for assay, he emptied his pockets of the blue quartz ore and scooped up all he could carry of this rich concentrate; and securing enough old tent canvas to form a crude sack, he took as much as he could carry in his arms.

Burdened thus, he stumbled back over the trail to his camp at the water tunnel, pausing only for a long drink at the willow pool. He kept secret from his crew the gold and his wonderful discovery, changed clothes and took the train at Danby for Los Angeles, where he found the gold he'd brought out was even richer than he had imagined.

Accordingly, he resigned his railroad job and hunted up an old friend, who was easily induced to take a partnership in the mine. Several weeks passed in celebrating this rich discovery and in buying an outfit and equipment for developing the mine; but, when they finally landed at Danby, secured pack animals and set out for the mine, to Tom's dismay he couldn't find that old dim trail again.

They spent days searching everywhere, but it was no use and Tom's partner at last quit in disgust. Tom later explained that while he'd been in Los Angeles there had been some violently heavy rains and probably the trail had been washed out and thus lost. And he admitted also that either going to the mine or returning, he'd paid scant attention to his general direction, or to the surrounding topography. This in itself, considering Schofield's long experience as a prospector, is very surprising to say the least. However, although he kept on hunting through the Clippers, he never did find that strangely vanished trail and finally had to give it up entirely. So far as he was concerned, the veins of blue quartz laden with rich gold and the dutch oven filled with bullion has ever since remained irrevocably lost.

AND HERE, the tale of the Lost Dutch Oven Mine takes a most surprising and fantastic twist. For by a queer coincidence, that same fall of 1941 when we searched the Clipper Range for this mine and found no trace of old Tom's landmarks, the Dutch Oven Mine had publicly been claimed as found. Returning from our expedition, we found the tale of its re-location in the October issue of Desert Magazine.

According to this story this lost mine was re-discovered by another prospector who remains nameless, but who after staking several claims along the length of that sheer zone of blue quartz, had leased it all to a mining man named Clifford Gillespie, who right then was engaged in developing the old mine. But the strange part of it is that the old mine is *not in the Clipper Range*, but in the northern part of the Old Woman Range, which is about ten miles *southeast* of Danby.

The story in the above magazine was written by a well known writer, Rexford Bellamy, who learning that Gillespie had leased the re-discovered Lost Dutch Oven mine went to Danby to check this news. He went from Danby over the trail to the old lost mine, and what he found is so interesting that we take the liberty to quote him verbatim:

"From Johnny Neilson's store . . . we drove a short distance south to the old Danby station on the Santa Fe, just a few shacks dotting the desert between the Old Woman and Clipper mountains, then took a rough miner's road off southward.

"From this we branched off into the foothills of the Old Woman range. Stopping at the mouth of a canyon, we followed the tracks of mountain sheep for a few hundred yards to a spring seeping from a rocky wall into a drinking pool. Beyond this canyon the rough road crosses three ridges or hog-backs, then goes upward until it makes a turn onto a level space confronting a narrow passageway between two high ledges of rock. True to the story, it is barely wide enough for a packed animal to pass. It fits the (Schofield) description unmistakably. You cannot doubt it is the one that Thomas Schofield discovered in 1894.

"Now, there is a cool spring near the entrance of the rock-cleft canyon. It is used by the miners who have sublet one of Clifford Gillespie's claims a few yards away. Winding upward, we sighted the old-time trail with the great black boulder-like mass beyond.

"On foot we followed the old trail, rounded the big black rock, came upon an old abandoned campsite. Smoke-stained boulders formed a fireplace. Other boulders were arranged in a rectangle that may have been around a tent. We found tailings from past gold pannings, an ancient rusted campstove, all there in evidence of pioneer gold prospector's camp life.

"From the abandoned campsite we climbed the old trail along the perilously steep canyon side, up to the weatherbeaten windlass over the old mine that is still timbered with split railroad ties just as young Schofield says he found it nearly 50 years ago. With the (Schofield) story in hand, we had followed the ancient trail, checked the fixed landmarks, all pointing conclusively to the fact that here was the Lost Dutch Oven Mine."

The above account is factual and leaves little doubt that the mine now being operated by Clifford Gillespie is the same found by Tom Schofield in 1894. But, since it lies a dozen miles from Danby in directly opposite direction from the Clipper Range, it leaves one amusedly speculating as to how young Tom could possibly have had his orientation twisted by a full 180 degrees. For at his age in 1894, certainly his memory must have been perfected normal and adequate. So the one possible explanation seems to be that the celebration of his discovery in Los Angeles left him so confused that he lost a fortune thereby.

However, Schofield had other mining interests and was known to have been finding and selling new prospects. No doubt he kept on doing this, after he lost his famous Dutch Oven property. In fact, he is reported to have sold one mine outright for $15,000.00, and had interests in others. At any rate, when we met him in 1941 at Danby, he was living at Chambless very comfortably in his old age, on a good monthly income from his interest in at least one mine he'd found.

When we met him that fall he must have known that his lost mine had really been re-located and was being worked. He did appear to be somewhat dazed, or maybe bewildered, as a matter of record. But, as for his assertion that he found this old mine in the Clipper Range, his close friends say that he never in so many words said he found it in the Clippers; but that, while driving that water tunnel for the Santa Fe, he used his spare time in prospecting and found the Dutch Oven Mine.

In any case, the "Dutch Oven" is off the list of lost mines.

(From Page 16)

Prof. A. H. Sutton, University of Illinois. Prof. G. Ubaghs, University of Liege, is working with the Echinodermata of Belgium, Prof. N. N. Yakovlev, Chief of the Geol. Committee, U. S. S. R., with crinoids of the Ural Mountains. Dr. Raymond Peck, University of Missouri, has presented various micro-crinoids of Missouri, and an astounding assemblage of Cretaceous micro-crinoids from Texas and Oklahoma. Dr. Josef Bouska, Ceske akademie, is working with crinoids of that country. Dr. I. G. Reimann has devoted his energies to blastoids. There are others, and one may easily see that considerable interest and work is being devoted to the advanced worms. The amount of time and effort involved is almost unbelievable — collecting, cleaning, photography, study, indexing, etc. Yet the work is only started, a minute fraction of the whole known.

There is a great opportunity for the amateur collector to assist in these research problems and to receive the satisfaction of scientific recognition — but there is also a great potential damage to scientific knowledge through amateur action. In a recent conference it was brought out that two of the greatest faults among amateur collectors are, 1) disregard for recording location where specimens are found, 2) the tendency to hoard highly valuable scientific specimens. It was even intimated that amateur paleontologi-

(To Page 25)

(From Page 23)

cal activity should be supressed because of these factors, or at least that too much encouragement should not be given. It is my belief that great strides can be made with the assistance of amateurs (I am one myself), and that the problem is simply to show the importance of cooperation and accuracy to the collector. It has been my personal observation that the average collector is receptive to logical reasoning, though there are exceptions.

There are two main phases in the scientific study of any fossils, the strictly biologic and the stratigraphic. All forms of life evolve (change) and in this respect are used as indices of various horizons. Let us suppose that I were to receive a group of Pennsylvanian crinoids from a collector who did not think it necessary to keep the location and horizon of his specimens and simply labled them "near 'Hometown', Kansas — Stanton formation." We will further assume that some of the specimens were collected in a road-cut 15 miles east of town, the others in a quarry 20 miles west of town, and that I made no further effort to check the information given, but simply wrote up the species involved as being from the Stanton formation. It is entirely possible for the outcrop first mentioned to be Stanton but very probable that the outcrop west is an entirely different and younger formation, and therefore specimens would be recorded from an older formation, voiding their biologic significance, and confusing comparison with forms from similar formations in adjoining areas. This is a mild example of possible erroneous interpretations based on inaccurate information.

It was recently my good fortune to receive a selection of crinoids demonstrating the acme of cooperative action in these studies. In correspondence with an advanced amateur paleontologist, Mr. Frank Crane of Ft. Worth, Texas, it developed that he had a small selection of Pennsylvanian crinoids from the vicinity of Ardmore, Oklahoma. He was not only considerate enough to send the specimens for study but persuaded another friend, Mr. William Watkins of San Antonio, Texas, to send a selection he had collected from the same outcrop. The area involved was an isolated part of the ocean which existed in Pennsylvanian time and is known today as the Ardmore Basin. The specimens proved to be an entirely new fauna which will result in

(To Page 32)

(From Page 11)

in the United States, however, goes into the manufacture of fire-proof shingles and other types of roofing for the beautification and protection of our homes. Each year there is enough of this kind of roofing sold to cover something l i k e two million homes (in ordinary years, that is). When the building boom starts again, this figure will undoubtedly soar even higher.

The uses of versatile asphalt are not confined to such earthy things as road construction and building, however. Modern flying fields and airports require landing strips and runways for airplanes that must be firm, smooth, impervious to water, and yet somewhat resilient so that the passengers won't be jarred too much when the planes are landing. Asphalt pavements a n s w e r all of these requirements and far outstrip all other materials for this particular use.

Asphalt even helps us play! Tennis courts of this material are recognized by the world's greatest players as being the ideal combination of smooth surface and springiness. In many communities, playgrounds of a s p h a l t are in use. These playgrounds can be easily flooded with water in winter and so used as ice skating rinks.

Not only is asphalt water-proof, but it is also proof against acids and alkalies. Therefore, most of our battery boxes are made from this age-old material. Likewise, asphalt's resistance to heat renders it a preferred material for such enamel paints as are used on automobiles where great heat is encountered. Other kinds of thick asphalt paint are smeared on the inside of the steel bodies of cars to absorb much of the road noises, thereby making motoring more quiet and restful.

Of late years, asphalt has become a watch-dog which guards lives and property along t h e courses of our largest rivers. Flood control along the courses of these rivers has engaged the anxious efforts of both engineers and the Government. In this important problem, the protection of the river banks from scouring and destruction has always presented a grave problem. Mats m a d e from various materials have failed to give adequate protection. It remained for asphalt to solve this problem through the actual paving of sections of the bed of the Mississippi River from above low water mark to the channel. Great "mattresses" of asphalt were used in this work — something like a Fifth Avenue pavement on the river bed!

Many of our modern uses of asphalt are but ancient u s e s which have been re-discovered by modern engineers. But our engineers and research men are going much further than did the craftsmen and builders of five and six thousand years ago. They are not resting content with the things that asphalt can already do.

These far-visioned men of the test tube, beaker, and slide rule believe that in spite of the sticky mineral's long and honorable record of service to mankind, its greatest usefulness lies in the *future*, rather than in the *past*. But even without peering into the future, asphalt can right now be regarded as one of the most versatile as well as one of the most useful of all natural products.

THE METEOR

By James Robert Allen

Across the ebon veil of night
A flaming vagrant cuts the skies;
In one bright flash of radiant light
It lives dangerously, and dies.

Far better be a shooting star—
A momentary blazing spark,
Than wander endlessly afar,
A stone forever cold and dark.

CLASSIFIED ADVERTISEMENTS

Rate 5c per word. Minimum advertisement $1.50. All ads must be in our office on the tenth of the month preceding date of issue.

AGATE

LOOK TO OREGON for fine gem cutting material on approval. See it before you buy it. Beautiful agate of many types and colors, jasper, agatized and opalized wood, various color obsidian and many others — slabs of above each priced separately sent on approval upon receipt of $5.00 or more deposit. Cutting and polishing done. **Lee Stradley, 8325 S.E. Mill St., Portland 16, Oregon.**

BEAUTIFUL AGATIZED WOOD from North Dakota. Assorted colors two pounds for $1.00. Fossil cat-tails and selenite crystals at the same price per pound. (Please include 30c postage). **L. Manning, Hettinger, North Dakota.**

AGATE FILLED NODULES (Thunder Eggs) from the noted Priday ranch locality in central Oregon. Whole eggs 2½ to 3½ inches, 50c a pound or 10 lbs. for $4.00. 20 lbs. $7.00. Send postage. Also fine cabochon cutting at wholesale prices. Expert work guaranteed. **Stanley Brown, 297 Kellogg Park, Portland 2, Oregon.**

AGATES, JASPERS, AGATIZED WOOD, and other specimens. Three pound assortment for only $1.50. Please add postage. Also **Nevada** Wonderstone. **Al Thrower, Box 305, Santa Cruz, Calif.**

NEW MEXICO AGATE. A galaxy of colors and patterns. $1.00 per pound, five pounds, $4.00. Sliced material, 20 cents per sq. in. up. Priced by the slice or a full pound of slices for $6.00. **James T. Lawyer, Industrial Minerals, 923 W. Birch, Deming, New Mexico.**

BOOKS and MAGAZINES

AM STILL in the market for March issues of The Earth Science Digest. Will pay 40c each for copies in good condition. Send them to: **Mr. Mason, care of The Earth Science Digest, Box 57, Omaha 3, Nebr.**

CUT GEMS

JEWELRY stones removed from rings, etc. 100 assorted $2.40. 50 large ones $2.40. **B. LOWE, Holland Building, St. Louis 1, Mo.**

25 Beautiful Nevada Mineral Specimens neatly mounted and identified in a cardboard box, $1.25 postpaid. Obsidian 50c to $1.00 per lb. Jasper 50c per lb. Postage extra. **Earl A. Dillwith, Dyer, Nevada.**

ZIRCONS—GENUINE SIAMESE exotic gems. Flash fire and sparkle like diamonds. Ancient Egyptian queens treasured the good luck bearing charm of these fascinating jewels. Mastercraftsman diamond cut. Unmounnted. Wholesale $1.50 per carat. Sample $2.00. Two for $3.00. Ten small glistening Zircons $4.00. **IMHUSEX ESD, White Plains, N. Y.**

FINE PAPERWEIGHTS — Pen mounts. Matched sets, many types. Featuring the Texas flourescent turitella. Sent on approval. Discount to dealers. **Clay Ledbetter, 2126 McKenzie, Waco, Texas.**

FOSSILS

FOSSIL COLLECTORS ATTENTION. 10 beautiful fossil specimens all different $2.00. 10 beautiful mineral specimens all different $2.00. Postpaid. Satisfaction or refund. **The Rock Hunter, R. 1, Alton Sta., Kentucky.**

OVER 5000 BUYERS read the classified columns of The Earth Science Digest. Your ad on this page will produce results.

MINERALS

DINOSAUR BONE, AGATIZED AND COLORFUL. This material is no ordinary fossil bone. It is free of pits and fractures and is all gem quality. ¼ inch slabs, $1.00 per sq. in. Top quality petrified wood, 20c per sq. in. Postpaid. **Bryon Davies, Cannonville, Utah.**

25 CENTS WILL BUY you a polished limb section of Eden Valley Petrifed wood. Better specimens of complete limb sections at 50c and $1.00. Postage extra. **Gems of the Rockies, 303 West Bijou Street, Colorado Springs, Colorado.**

MINERAL SPECIMENS: Micro-mount and Thumb-nail sizes. Write today for free list. **J. E. Byron, Mining Engineer, 1240 Pearl St., Boulder, Colorado.**

25 BEAUTIFUL, colorful Ozarks, 2½" specimens, including 3 cutting and polishing materials, blue and brown chalcedonies, rose and green jasp-agates, red jaspers, drusy and milky quartz crystal clusters, calcites, onyx, breccias, colites, crinoids, brachiopods, and vari-colored flints. Sent postpaid for $2.00. **John Jennings, Eureka Springs, Ark.**

MONTANA MOSS AGATE. Some color and some scenes, 10 pounds $6.75 - fifty pounds $24.75 - one hundred pounds $39.50. Minnesota agate, $3.50 for ten pounds. Catalogue of antiques and relics free. **Guy Saulsbury, Spicer, Minn.**

DOLLAR BARGAINS: (1) 10 small quartz crystals: (2) 2 Needles palm specimens, fiber, eyes, polished: (3) 3 lb. fluorescent assortment: (4) Slab Needles Palm: (5) 6desert rose formations: (6) Specimens Pyropholite: (7) Specimen Garnet: (8) 20 individual palm roots petrified: (9) 2 Needles palm cabachons, fiber, eyes: (10) Moss Agate slice: (11) Mule Canyon Palm slice: (12) 2 lbs. Lavic Jasper, $1.00 each, or 12 items $10. Postage extra. **McShan Ranch Gem Shop, Box 22, Needles, Calif.**

SEA SHELLS

FRANK LYMAN SELLS FINE SEA SHELLS. ALL ARE SCIENTIFICALLY LABELED AND CLASSIFIED. PUBISHER OF "SHELL NOTES". WRITE: FRANK LYMAN, LANTANA, FLORIDA.

(From Page 7)

cate the exact position of extensive concentrations. This new use for Geiger counters will greatly facilitate prospecting. All previous methods will quickly become obselete in the light of this relatively new invention.

(From Page 15)

(the lilac-colored variety of spodumene) without breaking it. The name of the rare gem enclase even means "good cleavage" because of the high development of the same property.

Knowing about the existence of a cleavage plane will enable the lapidary to avoid it as a facet surface, especially as a large top or table facet. This should be done for two reasons. Cleavage planes tend to have a pearly luster, and the facet will seldom be clear enough. In addition, cleavage planes chip readily in parallel plates, giving a step-like effect. Almost everyone who cuts topaz is tempted to use the prominent basal cleavage of the gem as the largest facet, but this should be avoided; inclining the facet a few degrees to the base will yield a much better gem even though more effort is required.

Cleavage is described by indicating the ease with which it can be produced and the direction in which it takes place. A statement about the cleavage of a gem might read "perfect cubic," meaning that it cleaves very easily in three directions at right angles to one another, leaving a cube-shaped piece. "Distinct prismatic" means that the gem cleaves fairly parallel to a prism face of the original crystal.

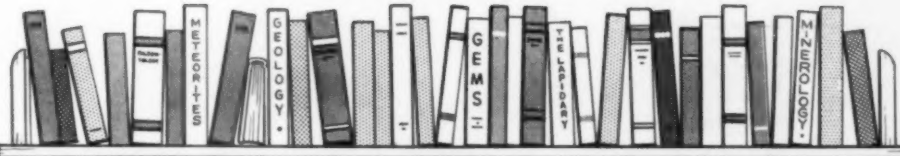
Hardness is a major factor in the lapidary's art inasmuch as it enables him to add to the beauty of a stone by putting a bright finish to it. The hardness of a gem determines the methods, equipment, and abrasive agents used in cutting and polishing it; these are discussed in the several good books on gem cutting that are on the market. Although every crystalline gem probably varies in hardness according to direction, the only gem that shows this difference to any conspicuous degree is kyanite, which can be scratched by a knife in one direction but not in others. Diamond, by far the hardest of gems, is the only one that is cut and polished at the same time; the surface is steadily ground down as the wheel revolves.

As gems go, obsidian is not hard. It is about 5 in Mohs scale of hardness, which is used most generally in mineralogical work. Flint will scratch it easily, and so will other varieties of quartz and numerous other minerals. Hence faceted stones cut from obsidian would, entirely apart from other considerations, make inappropriate settings for rings and similar jewelry because the hardness is inadequate to protect them from being badly scratched during normal wear.

(From Page 25)

a complete paper, with these two collectors receiving high scientific recognition for having discovered the material, and the specimens will be deposited in the U. S. National Museum as important "types". It is thus that an amateur passes from the comparative obscurity of a collector with some rocks in boxes to an internationally known figure in scientific research.

It must be kept in mind that any fossil collection properly labled as to where the specimens are found is a *scientific collection*, otherwise it is just a group of interesting rocks which no one may identify or use with accuracy.



The BOOK SHELF

Handbook of Uranium Minerals by DeMent and Dake. An exposition and catalog of the Uranium and Thorium minerals, including methods for their detection, location and exporation. An invaluable aid to all prospectors and miners on the lookout for these important minerals. **Price: $1.50.**

Revised Lapidary Handbook by Howard. This book is the successor to the author's Handbook for the Amateur Lapidary. A must for all gem cutters and potential gem cutters. **Price: $3.00.**

The Gem Hunter's Guide by Russell P. Macfall. A list of all important gem locales in the United States with information on not only where to find gems, but how to find them. Well illustrated. **Price: $1.00.**

Jewelry, Gem Cutting and Metalcraft by W. T. Baxter. Detailed methods of jewelry making, metalcraft, and gem stone cutting. Gives practical hints as to the best tools and materials, and such incidental information as how to cast rings, etc. **Price: $2.75.**

Outlines of Geology by Longwell, Knopf, Flint, Schuchert, and Dunbar. If you haven't a geology text you will want a copy of this book. Hundreds of illustrations. Actually two books combined into one. Used in schools and colleges in this country and abroad. We have only a limited supply of these texts, so order yours now! **Price: $4.50.**

The Art of Gem Cutting by Dake and Pearl. Anyone who contemplates pursuing the hobby of gem cutting should have a copy of this book. Written by H. C. Dake, editor of The Mineralogist Magazine, and Richard M. Pearl of Colorado College, it presents a wide variety of material on the most interesting of all hobbys. **Price: $1.50.**

BACK ISSUES OF **THE EARTH SCIENCE DIGEST.** For a limited time only we can supply a bundle of the following back issues for $1.00. October 1946, November 1946, December 1946, January 1947, February 1947. We have exhausted our supply of March 1947 copies. There will be no more of these available.

The Earth Science
DIGEST

BOX 57 OMAHA 3, NEBR.